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GERAGHTY & MILLER, INC.
Ground-Water Consultants
Since 30

March 23, 1988

Sauget Sanitary Development
& Research Association
c/o Mr. Warren Smull
Monsanto Company
800 N. Lindbergh Blvd.
Mail Code G4WM
St. Louis, MO 63167

Re: Response to IEPA/USEPA Comments Regarding the Sauget Sanitary Development & Research Association (SSDRA) Ground-Water Assessment Report

Dear Mr. Smull:

We have prepared the following responses to the Illinois Environmental Protection Agency (IEPA) and U.S. Environmental Protection Agency (USEPA) comments on the Geraghty & Miller, Inc. report regarding the ground-water assessment for the Sauget Sanitary Development & Research Association (SSDRA) in Sauget, Illinois. The agencies' comments appear in letters from the IEPA dated June 30 and August 3, 1987. Their comments have been divided into five sections as follows: Introduction, Ground-Water Flow, Ground-Water Contamination, Remedial Measures, and Additional Comments from the IEPA letter dated August 3, 1987. For your convenience, we have repeated the IEPA/USEPA comments in this order and our response follows each comment.

Introduction

IEPA/USEPA Comment:

The general conclusions of this joint review can be summarized by stating that the assessment needs to be expanded. Downgradient and deep aquifer conditions are not adequately described. Both onsite and offsite sources of contamination have not been sufficiently identified. The severe groundwater contamination is an areawide problem. The study must be comprehensive in scope. The recommendations for remedial action are far too narrow. Many good possibilities for remedial action were unnecessarily discarded or not considered at all. Known contamination problems representing substantial risks to the public health and environment are dismissed. Comments contained in the fol-

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lowing section support the aforementioned conclusions (abstracted from June 30, 1987 letter).

The agencies suggest that a major monitoring well network be installed in the old lagoon and pit area of concern to SSDRA. This area now contains unlined overflow water impoundments which receive flush water from the existing storm sewer during an overload. The monitoring well network should be expanded to include the land adjacent to the antiquated storm sewer pipeline (abandoned) and the presently used box culvery system (abstracted from August 3, 1987 letter).

Geraghty & Miller, Inc. Response:

Geraghty & Miller, Inc. does not believe that the scope of the ground-water assessment it has conducted on behalf of SSDRA requires a major expansion; however, some additional work is in progress because new information has become available. The preliminary study, combined with the well installation, sampling, and boring program, constitute a comprehensive study that has covered the entire plant site sufficiently and has investigated all three hydrogeologic zones in the unconsolidated deposits. The work undertaken to date is certainly sufficient to choose a conceptual approach to remediation for the four old treatment lagoons and the pit north of Lagoon 1.

The preliminary study included a thorough search of SSDRA, state and federal documents in the area, as well as a well inventory to determine whether or not wells within one mile of the property were providing drinking water. (It should be noted that Monsanto no longer has any wells.) The results of the Phase I study were used to develop the scope of work for the ground-water investigation on-site. The 14 wells and 12 borings were installed in areas of known or suspected contamination. These wells and borings, along with boring information developed from Russell & Axon (the new treatment plant contractor) and the dewatering wells on the property, provided an adequate database for evaluating ground-water conditions. Well drilling was done in phases so that each successive phase relied on the data obtained in the previous one and data gaps could be filled.

During our investigation, only three source areas of potential contaminants were identified. One is the area containing the four old lagoons, the second is the "pit" north of Lagoon 1, and the third was an area that was identified in the USEPA remote sensing report as a possible old landfill. Borings BG-7, BG-8, and BG-9 were installed in this area and did not reveal any evidence of waste disposal. The surge impoundments at the old treatment plant were not regarded as potential sources of ground-water contaminants because they are lined with bentonite and are not unlined as

the agencies have reported. Approximately $9.5 million has been spent on upgrading the sewer system on the Treatment Plant Sites, and the box culvert system is no longer used for waste disposal but may be used for flood control from time to time.

New information on the old landfill where borings BG-7, BG-8, and BG-9 were drilled has become available, and additional work in that area (north of BG-9) has begun to characterize what wastes may be present in that area and what the areal extent might be. A work plan for a boring program was prepared, and drilling was completed in December, 1987.

Although the surge impoundments at the old treatment plant site are lined with bentonite, it is possible that a limited amount of leakage has occurred. Therefore, we plan to install wells upgradient and downgradient from the impoundments to assess their impact on the ground-water system. A work plan will be developed in the very near future for this work.

It is virtually impossible to monitor leakage from a sewer system because monitoring wells must be situated exactly downgradient from a leak, which is extremely difficult to do. Since the system has now been upgraded and the box culvert system is no longer used to discharge treated effluent to the river, we do not plan to install monitoring wells. The site coverage provided by existing monitoring wells is sufficient to characterize ground-water conditions on the site, including the potential impact from the sewer system.

We agree with the IEPA's contention that ground-water contamination is an area-wide problem which may involve other properties in the Sauget vicinity. However, SSDRA has neither the responsibility nor the authority to carry on studies off-site on the properties of others.

Our recommendations for remediation with respect to ground water were limited to addressing the potential sources of ground-water contaminants because, as the IEPA acknowledges on page seven of its June 30, 1987 letter, direct ground-water remediation is impractical. In addition, ground-water contamination does not constitute a health hazard (ground water is not being used for potable purposes) and any future plume will sharply attenuate before discharging to the Mississippi River.

SSDRA has undertaken an aggressive program to reduce, to the maximum extent possible, contaminant loading to the ground-water system. We believe that all significant and potential sources have now been identified. Remedial projects have included constructing the new American Bottoms

Regional Treatment Plant and upgrading the sewer system in the plant area to reduce exfiltration.

Although a diligent search for all potential sources was conducted and remedial programs were defined for the sewer system and lagoons and pit, additional work will be undertaken in the old landfill and the area of the old surge impoundments. In 1986, SSDRA authorized Geraghty & Miller, Inc. to undertake a long term ground-water monitoring program which is continuing. If the long-term monitoring data indicate that additional remediation is required in particular areas, appropriate actions will be taken.

Ground-Water Flow

IEPA/USEPA Comment:

The study consists of an inventory of wells within a two mile radius of the site (excluding Monsanto wells), the drilling of twelve soil test borings, installation of fourteen monitoring wells at seven locations, determination of hydrogeologic parameters and identifying concentrations of hazardous constituents in the groundwater. Previous studies of the site were referred to but they were not available for cross-checking with the newly acquired information.

We concur with G&M's assessment that there are both on-site and off-site sources for the contamination present in the groundwater. The old pit and lagoons have probably been the source for some of the chemicals, while the Krummrich site (and probably others as well) may have been the source for other chemicals, such as the chlorinated nitrobenzenes.

We may or not concur with G&M's assessment that the "waste is always above the water table" (p.31), since this question does not appear to be adequately addressed in the study. For instance, the chemical analysis results for Soil Boring #BG-3 indicate major contamination at the deepest point sampled for chemical analysis, 7.5 ft. (Table 11), while HNu readings of 175 ppm were recorded at BG-3 at the maximum depth of the boring, 9-10.5 ft. (Table 10). The nearest monitoring well to this boring, GM-22A and B, also shows major contamination, and the depth to groundwater was about 16.2 ft. below the surface during the high stage of the Mississippi River on November 21, 1985 (Tables 3 and 4). Thus, it is conceivable that groundwater in this area may be moving up into the contaminated soil during high water periods on the Mississippi, since there was a difference of only 5.7 ft. between the bottom of BG-3 and the groundwater at high stage, and no samples were taken between 10.5 and 16.2 ft. below the surface.

The groundwater assessment is based principally on two premises. One, because concentrations particularly organic

compounds increase with depth, the primary source of the contaminants are offsite, upgradient, to the east. Two, due to low groundwater velocity it is unlikely that any contaminants from the lagoons and pit have yet reached the river. However, the report's explanation of the highest recorded mean concentrations of pollutants in Well GM-22A refute this analysis. The pollutant load of 4900 ug/l reported in the water table zone of Well-22 is attributed to the old pit as the source but some of the organic compounds are attributed to an offsite source. The maximum reach for the contaminants in the water table zone is calculated as about 150 feet (7.3 feet per year for twenty years of activity at this site. Well GM-22 is 400 feet from the pit and over 2000 feet (equivalent to 275 yrs.) from the nearest upgradient source. Either the sources of the contaminants are incorrect, or the groundwater velocity is incorrect, or both.

A more probable hypothesis is that the contaminants migrate from the lagoons and pit in discreet plumes (or "fingers") rather than the lagoons and pit acting a large point source creating one homogeneous plume. The chances of one of the five shallow downgradient wells intersecting a "finger" would depend upon the geometry of the plume(s). Judging from the range of concentrations and identified constituents, it is probable that the contamination plumes have not been fully located and the contamination in general has not been fully characterized.

We would like to point out that G&M indicates that groundwater movement fluctuates with the stage of the eastward (p.9) and the intermediate zone 4500 ft. eastward (p.10) during high stage. This reinforces our opinion that the water table moves up and down as well as back and forth in the American Bottoms, depending on the stage of the Mississippi.

Figure 10 and Figure 13 of the report on the Sauget Treatment Plant Site demonstrate that groundwater flow direction can, and no doubt has, reversed many time in recent history. Groundwater elevations also vary at such times. The effect of these circumstances on the history of the site, the migration of contaminants and on proposed remedial actions is not discussed in sufficient detail by Geraghty & Miller.

Geraghty & Miller, Inc. Response:

The IEPA/USEPA stated that we referred to previous studies of the site but we did not make them available. Each one of our references was listed in the report on page 34, with the exception of the boring program undertaken by Russell & Axon, Inc. for which no formal report was prepared. If there are specific data or a report that either

agency would like to review, we will be happy to provide copies.

Ground-water level measurements and river-stage data indicate that the water table in the old lagoon area will not rise above the bottom of the waste which is about 404 ft above NGVD (National Geodedic Vertical Datum). On August 24, 1984, the Mississippi River stage was 7 ft above the U.S. Army Corps of Engineers' datum at the Market Street station in St. Louis, Missouri, and the water level in Well GM-22A was measured to be 393.97 ft NGVD which is 11 ft below the waste. On November 21, 1985, the river stage was 32 ft above the same datum and the water level in GM-22A was measured at 396.32 ft above NGVD, which is 2.35 ft higher than its level on August 24, 1987 and still 8 to 9 ft below the waste.

Total precipitation for the 30 days prior to the August 1984 water-level measurements was 0.34 inches, with no rainfall occurring during the week preceding the water-level round. Total precipitation for the 30 days prior to the November 1985 measurements was 9.48 inches (rainfall), with 6.85 inches falling during the week preceding the water-level round. Even with heavy local precipitation accompanying a 25 ft rise in river stage, the water table at GM-22A rose only 2.35 ft.

Using the August 24, 1984 and November 21, 1985 water-level measurement as a guide, the elevation of the water table at GM-22A at the highest river stage ever recorded can be estimated by a simple proportion. If a 25-foot difference in the river level caused a 2.35 ft rise in the water table, then a of 36-foot difference (to 43.3 ft above datum, the highest level ever recorded) would correspond to a rise of 3.4 ft. This corresponds to a water-table elevation of 397.4 ft above NGVD, which is more than 6 ft below the waste source in the lagoons.

Our ground-water assessment is not based on the premise that ground-water contamination increases with depth. The results for well cluster GM-22AB provide an example of contamination that has been detected in the water-table zone and, to a lesser degree, in the intermediate zone. However, we do believe that contaminants in the intermediate zone may have originated from sources to the east of the site.

The IEPA/USEPA point with regard to the source of contaminants in Well GM-22A is a good one. Given the ground-water flow, the ground-water velocity in the shallow zone, and Ecology & Environment's recent work in the Sauget site study, the most likely source of contamination in Well GM-22A is the northwest corner of the old lagoons, not the pit. This well was installed adjacent to the westernmost lagoon. Our use of the term "off-site source" referred to property